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INFANTRY ANTI-TANK WEAPONS :

VOLUME 1 : 89 MM ROCKET LAUNCHER

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FEBRUARY 1979

RESTRICTED

INFANTRY ANTI-TANK WEAPONS

PREFACE

1. This is the first of a series of volumes to be published to compile a complete manual on infantry anti-tank weapons.

2. Each volume issued replaces previous manuals iro that specific weapon and should be used for training and employ= ment purposes.

3. I trust that the manual will enable you to develope a high standard of anti-tank ability in the SA Infantry.

4. Proposed amendments and proposals should be send annually during July to Chief of the Army, Doctrine section. Amendments will be issued by this Headquarters.

CHIEF OF THE ARMY : LT GENL

AMENDMENTS

Amendment No	Date Amended	Amended by	Amendment No	Date Amended	Amended by
a.	b.	c.	d.	e.	f.

INDEX : 89 MM ROCKET LAUNCHER

Chapter	Page
Chapter 1 : Characteristics	1-7
Chapter 2 : Description of the Weapon	2-4
Chapter 3 : Ammunition	3-9
Chapter 4 : The Sight and Aiming	4-8
Chapter 5 : Loading, Firing and Unloading	5-6
Chapter 6 : Maintenance	6-2
Chapter 7 : Employment of the Weapon	7-8

Fig 1 : 89 mm Rocket Launcher.

89 mm ROCKET LAUNCHER

CHAPTER 1 : CHARACTERISTICS

AIM

1. To explain the characteristics of the 89 mm Rocket Launcher and their effect on the employment of the weapon.

INSTRODUCTION

2. The Armour Threat to Infantry. To enable infantry units to counter armoured attacks, they need an effective anti-tank weapon. This would need to be accurate, of as long range as possible, and capable of piercing heavy and composite armourplating mounted at steep angles of inclination. The weapon would have to be portable without handicapping infantrymen in battle order.

3. An Effective Weapon. The 89 mm Rocket Launcher has been introduced to provide the Company/Platoon with an accurate, lightweight anti-tank weapon.

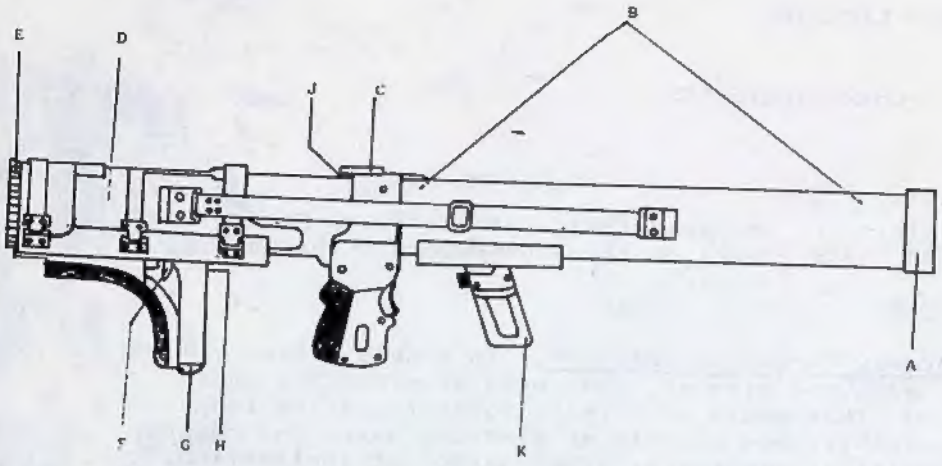
4. Description. The 89 mm Rocket Launcher is a light shoulder, controlled open-fibre glass tube and has no recoil. It can be fired from any of the normal firing positions. The weapon is fired electrically by a small magneto, which is operated when the trigger is pressed. The sight is self-ranging and has a three-power magnification, which contributes to the accuracy of the weapon.

CHARACTERISTICS

5. Technical Characteristics

a. Measurements

i.	Length of weapon in carrying configuration	-1,17 m.
ii.	Length of ammunition	-0,60 m.
iii.	Length of firing configuration	-1,60 m.



A : Muzzle Protector
B : Auxiliary Sight
C : Optical Sight Base Protector
D : Cheek-rest
E : Optical Sight
F : Shoulder-Rest Push-Button
G : Bipod Stop
H : Bipod Lock Push-Button
J : Optical Sight Base
K : Front Handle

Fig 2 : 89 mm Rocket Launcher in carrying configuration.

b. Mass

i. Mass of weapon in carrying donfiguration - 5,5 kg.

ii. Mass of rocket in container - 3,2 kg.

iii. Mass of two rockets in carrying container - 7,0 kg.

c. Calibre

i. Weapon - 88,9 mm.

ii. Diameter of shaped charge - 80 mm.

d. Penetration. The High-explosive Anti-tank (HEAT) ammunition is effective against any known tank.

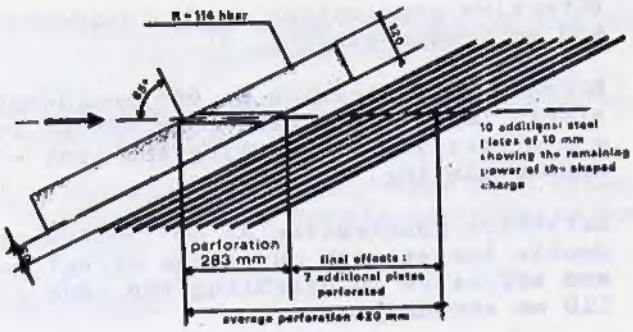


Fig 3 : Penetration of NATO single target (Heavy tank type).

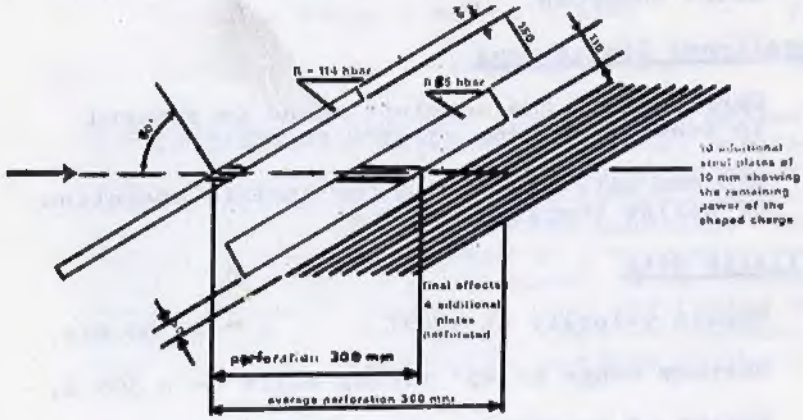


Fig 4 : Penetration of NATO double target (Medium tank type).

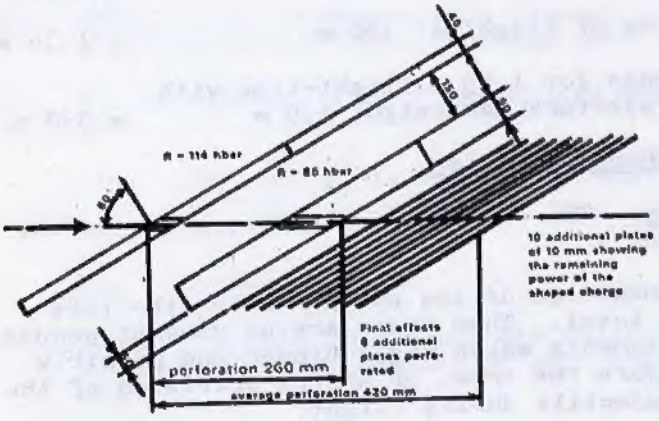


Fig 5 : Penetration of NATO double target (Medium tank type).

i. Effective penetration at 0° incidence - 400 mm armour-plating.

ii. Effective penetration at 65° incidence, single target with dangerous effect to area, and effective in disabling the tank - 120 mm armour-plating.

iii. Effective penetration at 60° incidence, double target with dangerous effect to crew, and effective in disabling the tank - 40 x 110 mm armour-plating.

iv. Effective penetration at 0° incidence - 1 metre concrete.

e. Operational Limitations

i. Operation of the complete round is ensured in conditions from -31,5°C to +51,5°C.

ii. Minimum safety distance for certain operation of hollow charge 4 to 10 m.

f. Ballistic data

i. Muzzle velocity at +20°C - 300 m/s.

ii. Maximum range at 45° firing angle - 2 300 m.

iii. Height of trajectory above horizontal at 350 m - 2,2 m.

iv. Time of flight at 350 m - 1,36 s.

v. Range for 1,25 s flight-time with trajectory max height 1,9 m - 330 m.

6. Employment Characteristics

a. Accuracy. The weapon is accurate, owing to the following :

i. Combustion of the charge inside the tube is total. Thus there are no unburnt powder fragments which might hinder and possibly injure the crew, or affect precision of the projectile during flight.

ii. The three-power magnification of the sight contributes towards accuracy.

iii. The Optical Sight is self-ranging up to a range of 500 m.

iv. The adjustable shoulder rest with bipod and retractable front handle contributes towards accuracy.

b. Planning Ranges

i. Maximum range at 45° firing angle - 2 300 m.

ii. Planning range - moving target - 330 m.

iii. Planning range - stationary target - 600 m.

c. Increased Rate of Fire. The complete projectile is packed in a container-type packing. Before loading, both closing plugs are removed from the container; the container is then introduced and locked into the rear end of the launcher. The locking is secured by means of a bayonet-type socket. The circuits integrated in the container ensure automatic connection with the firing generator handle of the weapon. This arrangement results in a very appreciable increase in the firing rate.

d. Flexibility

i. Owing to the design of the weapon, it can be employed with accuracy through 360°.

ii. The following types of ammunition are available :

(1) High-explosive Anti-Tank (HEAT).

(2) Smoke.

(3) Illumination.

iii. The weapon and ammunition are relatively light and can be carried to any position required.

e. Floatability of Equipment. During river-crossing or beach-loading operations, the launcher and ammunition will float, provided that the following are complied with :

i. Rocket Launcher -

(1) The muzzle protector cap is on.

(2) The optical sight is fitted and locked in the rear of the barrel.

(3) The sealed pistol grip containing the firing mechanism needs no preparation.

ii. Ammunition. With the front and rear protector caps on, sealed by the tape as supplied, the ammunition will be watertight and will float.

f. Effect of Meteorological Conditions. The weapon can be utilized under all weather conditions. Under adverse conditions - eg, rain, snow, dust-storms and very hot and bright sun , the weapon must be kept in its progective cover until just before firing.

g. Safety Precautions

i. Crew members must, during firing of the weapon, wear ear-protection equipment/plugs. This is due to the fact that the combustion of the charge inside the tube is total, and a sharp noise of high intensity is the result.

ii. The minimum muzzle-safety range is four metres. Beyond this range, any obstacle can cause the rocket to explode.

iii. Prevent any shock to the front part of the ammunition before firing.

iv. During firing of the weapon, ensure that there are no obstacles closer than three metres behind the weapon, to prevent ricocheting projections towards the crew.

v. Before firing ensure that there are no personnel or inflammable material within the dangerous area behind the weapon as indicated in Fig 6.

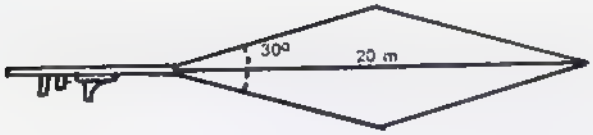


Fig 6 : Danger area of 89 mm
Rocket Launcher.

CONCLUSION

7. The light mass, accuracy and flexibility of the weapon contribute towards the capability of infantry to counter armoured attacks. It is thus very important that the com= mander knows the characteristics and constantly bears them in mind during the deployment of the weapon.

89 MM ROCKET LAUNCHER

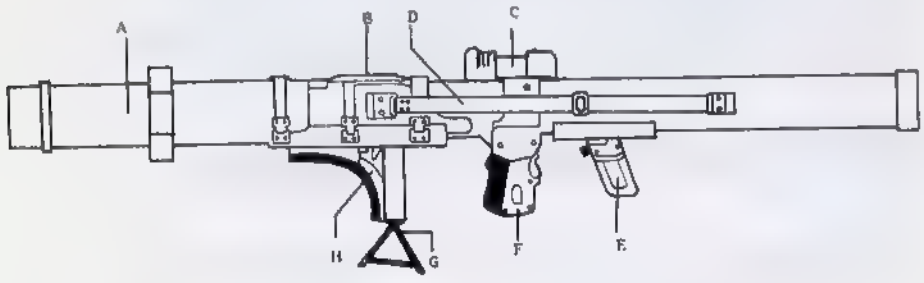
CHAPTER 2 : DESCRIPTION OF THE WEAPON

AIM

1. To introduce the 89 mm Rocket Launcher.

INTRODUCTION

2. The 89 mm Rocket Launcher, as accepted, consists of the rocket fired from the glass-fibre launcher tube, equipped with a 3 x magnification optical sight.



A : Ammunition
B : Carrying handle
C : Optical sight
D : Sling
E : Front handle
F : Firing handle
G : Bipod
H : Shoulder-Rest

Fig 7 : 39 mm Rocket Launcher in firing configuration

DESCRIPTION

3. The 89 mm Rocket Launcher. The rocket launcher comprises two essential sections :

a. The launching tube to which is attached all the required fittings for the use of the weapon.

b. The rocket in its container for transport and firing. The container is fitted to the rear end of the launcher tube as an extension, in order to provide the length required for a full combustion of the propellant inside the tube. The advantages/disadvantages of this arrangement are :

i. A high degree of accuracy is obtained.

ii. No protective clothing or equipment need be worn by the operator/crew.

iii. Owing to the complete combustion of the propellant inside the tube, a noise of high intensity is caused, and ear-protection must be worn by the operator.

4. The Launching Tube. The launching tube is a cylinder made of glass fibre. It is equipped with the following :

a. A lengthwise-adjustable shoulder-rest to conform to the operator's choice in a certain firing posi= tion. Inside the shoulder-rest is a rod with a small folding bipod at its lower end. This may be automatically positioned by pressing a control button. This arrangement enables the operator to set the weapon in the waiting position without strain.

b. A retractable front handle under the tube, which may be adjusted in position by pressing the con= trol button.

c. A watertight firing-generator handle consisting of the following :

i. The plastic material mount-housing which con= tains, in addition to the safety parts, the electro-magnetic system for generating the firing current.

ii. The safety grip of the mechanical system, constituting a primary safety device of mechanical nature. When the grip is pressed this safety device is overridden and the trigger may be operated. This safety device thus prevents accidental use of the trigger.

iii. The trigger, which provides the electrical current for firing the rocket when pressed.

iv. The current connector.

Note 1. In addition to the mechanical safety grip, there is also an electrical safety device. The circuit can only be closed by means of two microcontacts, the first on the safety grip when pressed and the second on the trigger when operated.

d. The optical-sight mount with protector situated in front of the protector is the rear part of the weapon's open battlesight.

e. The collapsible foresight of the battlesight attached to the muzzle bushing of the tube.

f. The strap for shoulder-carrying.

g. The optical sight, which forms a rear sealing plug for the weapon thus enabling the telescope to be transported inside the tube. It is fastened to the weapon by menas of an eccentric axis attached to the telescope. The sight is removed by turning it anti-clockwise and pulling it outwards.

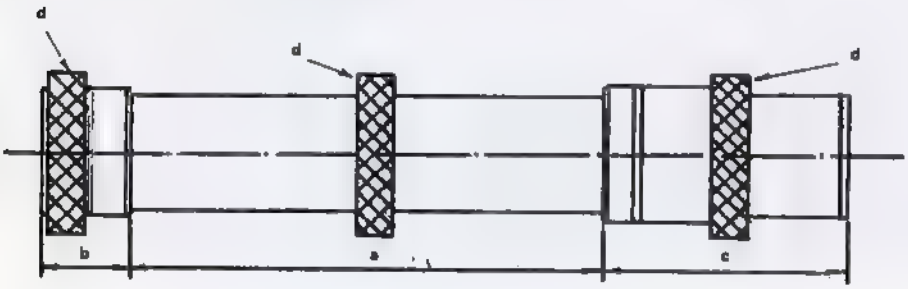
5. The Rocket and Container

a. The container comprises three sections :

i. The central body with rocket, which forms the extension of the launching tube, with centre buffer.

ii. The rear cap with buffer.

iii. The front cap with buffer.



A : Central body with centre buffer.

B : Rear cap with buffer.

C : Front cap with buffer.

D : Buffer.

Fig 8 : 89 mm Rocket.

b. Watertightness and Protection against Shock. Watertightness of both caps is secured by means of a plastic adhesive tape. Specially designed annulishaped buffers protect the rocket against shock, especially at Low temperatures.

c. Before Firing. The case caps are to be removed, and the central body inserted and secured to the rear section of the launching tube. The electric circuit integrated in the rear of the central body ensures automatic connection with the circuit of the firing generator handle, when secured to the launcher tube.

d. Safety During Transport of Ammunition. The electrical firing circuit is switched off as long as the rear cap is in position. Protection against radio-electric emissions during storage, transport, and handling before firing is thus ensured.

CONCLUSION

6. The mass of the launching tube has been considerably reduced by using low-density materials. Resistance to shock and wear during firing is better than for tubes made of usual materials. The tube is however not unbreakable and must be protected from unnecessary shocks and mishandling of the weapon system.

7. The rocket container completes the tube, and reduction of tube length for easier manhandling has thus been made possible. Owing to the rapid combustion rate, the combustion of the charge inside the tube is total. Consequently there are no unburnt powder fragments which might upset and possibly injure the operator. The weapon may thus be employed without the use of masks and protective clothing. Ear-protection is however essential.

89 mm ROCKET LAUNCHER

CHAPTER 3 : AMMUNITION

AIM

1. To introduce the different types of ammunition and explain the characteristics and handling before firing.

INTRODUCTION

2. The ammunition is a rocket type, propelled by a so-called "brush-type" propellant with a very rapid combustion rate. This ensures a very regular combustion which contributes towards a low dispersion in muzzle velocity. This is turn consequently yields excellent precision. Ignition of the propellant is electrically operated.

3. The rocket is fin-spin-stabilized. The spinning motion is imparted to the rocket by means of nozzle vanes. The High-explosive Anti-tank (HEAT) rocket employs the shaped-charge (hollow-charge) principle to defeat armour.

AMMUNITION

4. Types of Ammunition. Two types of ammunition are available :

a. Combat rockets consisting of :

i. HEAT rockets.

ii. Smoke rockets

iii. Anti-personnel rockets.

iv. Illumination rockets.

b. Practice rockets.

c. Ammunition for loading and handling practice purposes.

HET AMMUNITION

5. Description of Rocket. The rocket consists fundamentally of a head, containing the explosive charge and a tail section containing the propulsive and stabilizing system.

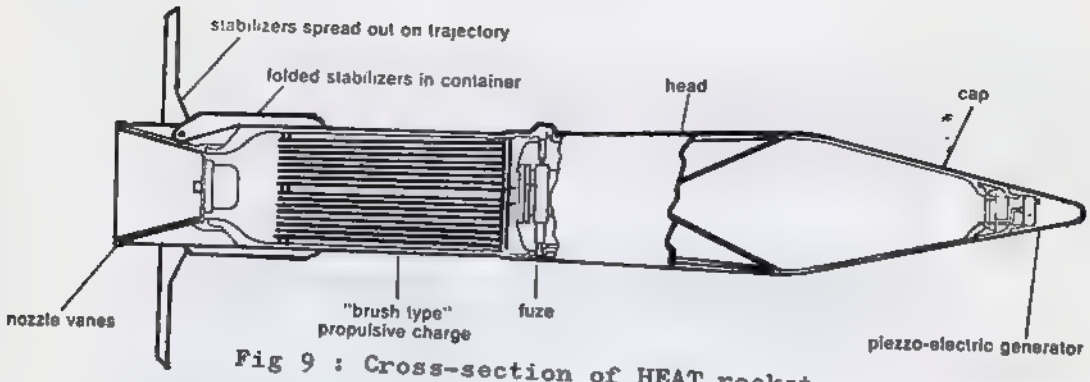


Fig 9 : Cross-section of HEAT rocket.

6. The Head of the Rocket. The head consists of the following :

a. The Ogive. Holds the shaped charge at the prescribed stand-off distance from the target to obtain the maximum effect of the jet burning its way through the armour. The ogive is made of plastic material. For maximum effect, the shaped charge must be at exactly the right stand-off distance from the target when it detonates. This stand-off distance is provided by the ogive or ballistic windshield, on the nose of the rocket head.

b. The Nose Fuze. On impact the fuze in the nose of the rocket is actuated by the piezo-electric element connected to a transformer. The electric current is conducted to the point-initiating base-detonating fuze by means of electrical connections fitted to the ogive. Owing to this arrangement the rocket will function at incidences as high as 75°.

c. The Shaped Charge. The shaped-charge principle employs an inverted cone-shaped explosive charge that is held in place by an aluminium-alloy casing, stremalined by a plastic material fairing. When detonated, the force and heat of the explosive focus to form a powerful jet, which burns its way through the armour.

d. The Point-initiating Base-detonating Fuze. Arming of the fuze is effected by tapping gases from the propulsion system. Owing to the time required for aiming and setting of the primer holder, the muzzle safety distance amounts to a minimum of four metres. The primer is actuated electrically by the piezo-electric element at impact on the target. Before firing of the rocket, the primer holder is locked in a safe position in the container and tube, simultaneously interrupting the electrical circuit from the piezo-electrical element.

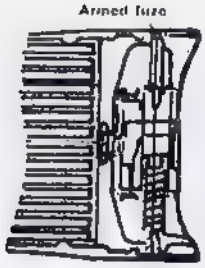


Fig 10 : The point-initiating base-detonated fuze.

7. The Tail Section

a. Propulsion System. This system comprises the following :

i. The "brush-type" propellant (propellant-sticks packed tightly together, giving a "brush" impression).

ii. The body and the nozzle of light alloy.

b. Stabilizing System

i. The spinning motion is imparted to the rocket by means of nozzle vanes.

ii. The tail of the body is equipped with a fin unit with nine retractable fins. With the rocket in the container, the fins are folded up along the body. The fins come out into the flight position by means of the spinning motion of the rocket acquired in the tube during firing.

8. Technical Data

a.	Diameter of shaped charge	80 mm.
b.	Total length of rocket	0,600 m.
c.	Length of container	0,626 mm.
d.	Total mass without container	2,2 kg.
e.	Total mass with container	3,2 kg.

f. Mass of propellant 0,3 kg.

g. Mass of explosive of shaped charge 0,365 kg.

9. Packing of Ammunition. The HEAT rockets are packed in impregnated cardboard boxes. Each box contains four rockets. The rockets are packed two at a time in a carrying container. A carrying strap is supplied with every carrying container. All ammunition, including the cardboard box containing four rockets, will float.

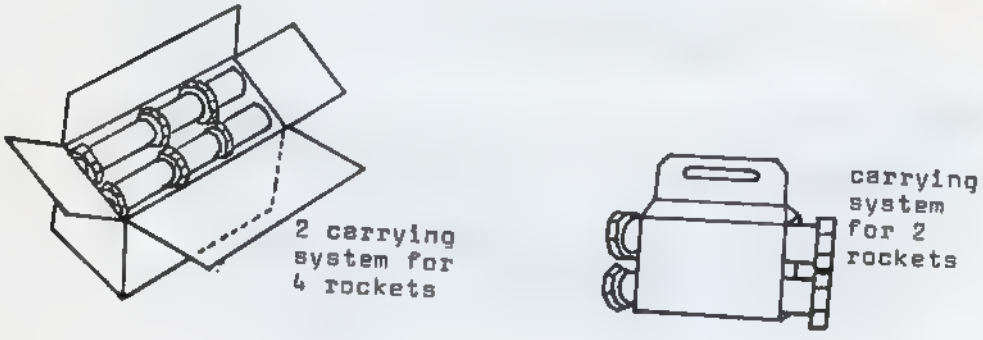


Fig 11 : Packing of HEAT ammunition.

PRACTICE AMMUNITION

10. Description. With the exception of lettering and colour, the inert-head practice rocket with impact marker looks identical to combat ammunition. The rocket is manufactured of lightweight materials, ie aluminium alloy or plastic material, which can not cause an actual target tank to be damaged; it does not endanger the crew protected by the vehicle.

11. Characteristics of the Practice Rocket. The practice rocket has the following characteristics :

a. The container with protector caps and buffer is identical to the container of combat ammunition.

b. It has the same streamlined profile, mass, and ballistic characteristics as the live HEAT rocket.

c. Muzzle velocity and time of flight are the same as for the HEAT rocket, as it is fitted with the latter's propellant system.

d. It has the same safety device as the anti-tank rocket.

e. Impact is visualized on a hard target or on ground by a puff of talcum powder contained in the head of the rocket.

f. The rocket is perfectly safe after firing as all elements are inert.

12. The Head of the Rocket. The aluminium-alloy inert-head contains the following :

a. A moulded plastic ogive identical to the anti-tank rocket.

b. The base of the ogive is fitted with a light-alloy box containing 185 grams of talcum powder.

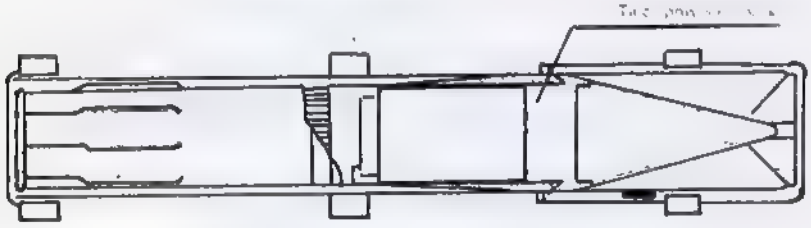


Fig 12 : Practice rocket with inert-head and impact marker.

13. The Tail Section

a. Propulsion System. The body and nozzle made out of light alloy, with a "brush" type propellant, identical to that of the HEAT rocket.

b. Stabilizing System

i. The spinning motion is imparted to the rocket in the tube during firing by menas of nozzle vanes.

ii. The tail of the Body is equipped with a fin unit with nine retractable fins. With the rocket in the container, the fins are folded up along the body. The spinning motion of the rocket brings the fins into position after leaving the tube.

14. Packing of Ammunition. Practice ammunition is packed identical to combat ammunition, with two rockets in a carrying container and four rockets in a cardboard container.

7,5 mm SUB-CALIBRE TRAINING AMMUNITION : MAS TYPE F1

15. Description. This training device comprises the following :

a. A container identical to the HEAT container, in which the following is fitted :

i. A barrel which can be adjusted for direction and elevation.

ii. A photoflash ignition system with batteries and condenser, which is electrically actuated when the trigger is pressed.

iii. A removable breechblock.

b. The rear and front caps of the container.

c. The electrical priming allows the rocket-launcher team to train on the weapon under the same conditions as for actual firing.

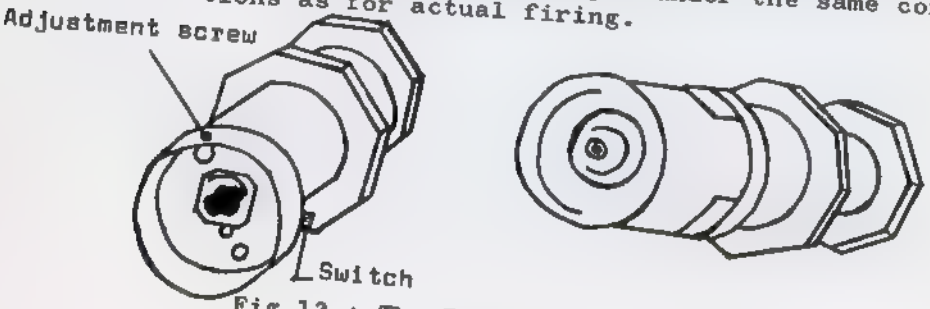


Fig 13 : The 7,5 mm Sub-calibre (MAS type F1)

16. Technical Data

a. Mass of container with equipment 3,10 kg.

b. Length 0,63 m.

c. Calibre 7,5 mm.

d. Type of 7,5 mm ammunition :

i. 7,5 mm Plastic Bullet.

ii. 7,5 mm Ball with tracer.

e. Application range of 7,5 mm Ammunition :

i. 7,5 mm Plastic 100 m.

ii. 7,5 mm Ball with tracer up to 250 m.

17. Utilization of the 7,5 mm Sub-calibre

a. Preparation of the Container

i. Ensure the front cap is on.

ii. Remove the rear cap.

iii. Remove the breech piece, inspect the barrel, and load the equipment by inserting a 7,5 mm cartridge in the chamber of the barrel.

iv. Replace the breech piece, and ensure that it is locked and that contact points are making contact on the contacts of the con= tainer.

v. Replace the rear cap. The sub-calibre is now ready for firing.

b. Firing of the 7,5 mm Sub-calibre. Firing is done under the same conditions as for combat and practice type of ammunition :

i. Remove the front cap.

ii. Ensure that arrow on the container corres= ponds with arrow on rocket launcher and lock by rotating the container clockwise.

iii. Remove the rear cap.

c. Unloading

i. Remove the container from the rocket launcher after having it unlocked by rotation.

ii. Replace the front cap.

iii. Unload the sub-calibre by removing the breech piece, remove the expended cartridge and reload if required.

iv. Replace the breech piece.

v. Replace the rear cap.

IDENTIFICATION OF AMMUNITION

18. As all ammunition containers are identical, ammunition can be identified according to colour :

	Type of Ammunition	Colour		Marking	Colour of Marking
		Front	Rear		
a.	b.	c.	d.	e.	f.
1.	F1 type 89 mm anti-tank rocket (HEAT)	Olive Drab		AC 89 F1	Yellow
2.	F1 type 39 mm Prac=tice Rocket	Blue	Olive Drab	89 x F1	Yellow
3.	7,5 mm Sub-Calibre MAS type F1	Olive Drab		Tube re=duced 7,5 F1 pour L.R.A.C. 89 F1	White

CONCLUSION

19. Safety Features

a. Owing to the time required for arming and setting of the primer holder, the muzzle safety distance amounts to four to ten metres.

b. Arming of the fuze is effected by tapping gases from the propulsive system. This featue pre= vents accidental fuze-functioning before fire.

c. A further safety arrangement to prevent acciden= tal fuze-functioning is the locking of the primer holder in a locked position in the container.

89 mm ROCKET LAUNCHER

CHAPTER 4 : THE SIGHT AND AIMING

AIM

1. To explain the employment of the optical sight.

INSTRODUCTION

2. In any battle - and especially in an armoured battle - a first-round hit is very essential. To be able to achieve this, the sight unit must be well known to the operator.

DESCRIPTION

3. The Optical Sight. This instrument is fitted with a right-angled triangular mounting piece which fits into a similarly machined bracket on the launcher tube which is the same on all weapons. This arrangement ensures interchange= ability of sights. The main body of the sight is made of magnesium alloy with a total weight of about 400 grams. All optical parts inside the sight are cement mounted. Optical characteristics are as follows :

a. Magnification : x3

b. Exit pupil : 7 mm

c. Exit pupil image : 35 mm

d. Eyepiece focusing : Fixed at 1 dioptry

4. Protection of the Sight. In order to protect the sight against accidental shocks, a wrapping of closed-cell low-pressure polyethylene foam has been designed. It constitutes a resilient padding which envelops the entire sight. The shape of the wrapping at the rear is designed to protect the operator's eye from possible recoil of the weapon. The wrapped-sight assembly forms a rear sealing plug for the weapon and thus enables the sight to be transported inside the tube.

5. Attaching and Detaching the Sight. The sight is at= tached to the bracket on the rocket launcher by the follow= ing procedure :

a. Open the optical sight base protector, situated on the centre-left side of the rocket launcher.

b. Pull the locking lever, attached to the sight, to the rear of the sight. The arrow on the sight is also an indication of the direction the lever must be pulled.

c. Place the mounting piece on the bracket of the rocket launcher. Ensure that the resting surfaces on the sight sit firmly on those of the bracket on the rocket launcher.

d. Push the locking lever towards the front of the rocket launcher. The eccentric pin on the locking lever must fit through the locking eye on the launcher bracket.

e. Pull the locking lever anti-clockwise and downwards until it touches the barrel of the rocket launcher. This rotating action will tighten the sight on its bracket, by means of the eccentric pin of the locking lever.

f. Remove the front and rear lens protectors by pulling them out. Press the two together in order to keep them out of line of sight.

g. The sight is detached by reversing the above procedure.

6. Replacing the Sight. During storage, transport, or any movement when not in contact with the enemy, the sight must be replaced in the rear of the rocket launcher. This arrangement protects the sight against any unnecessary shock and other damage. The following procedure is used :

a. Replace the front and rear lens protectors.

b. Ensure locking lever is lying against the sight.

c. Align the arrow on the sight and rocket launcher, and push the sight fully home.

d. Turn the sight clockwise until it stops.

e. Test that the sight is locked by pulling to the rear without turning the sight.

f. The sight is removed by reversing the above procedure.

7. The Reticle. The reticle pattern consists of the following :

a. The Vertical Axis Line

i. On top of the vertical axis line is a crosswire indicating zero range and deflection.

ii. Ranges 0, 100, 200 and 300 m are indicated by short interrupted horizontal lines. Each vertical line segment represents 100 metres range.

iii. Ranges 400, 450 and 500 m are indicated by broken horizontal lines with the ranges indicated by the numbers 4, 4.5 and 5 on either side of the vertical axis. Each horizontal line segment and each space between horizontal line segments represents an angular lead of 10 km/h marked with the numbers 10, 20 and 30.

iv. Ranges 600, 700, 800, 900 and 1 000 m are indicated by interrupted horizontal lines, marked with the numbers 6, 7, 8, 9 and 10.

b. Horizontal-Axis Line. The horizontal line, indicating 330 m range, is also the horizontal axis line of the sight, and is 20 m below the crosswire at 330 m.

c. Stadia Lines. Between the 100 and 500 m ranges, the curved stadia lines will represent a six-metre tank at the corresponding range.

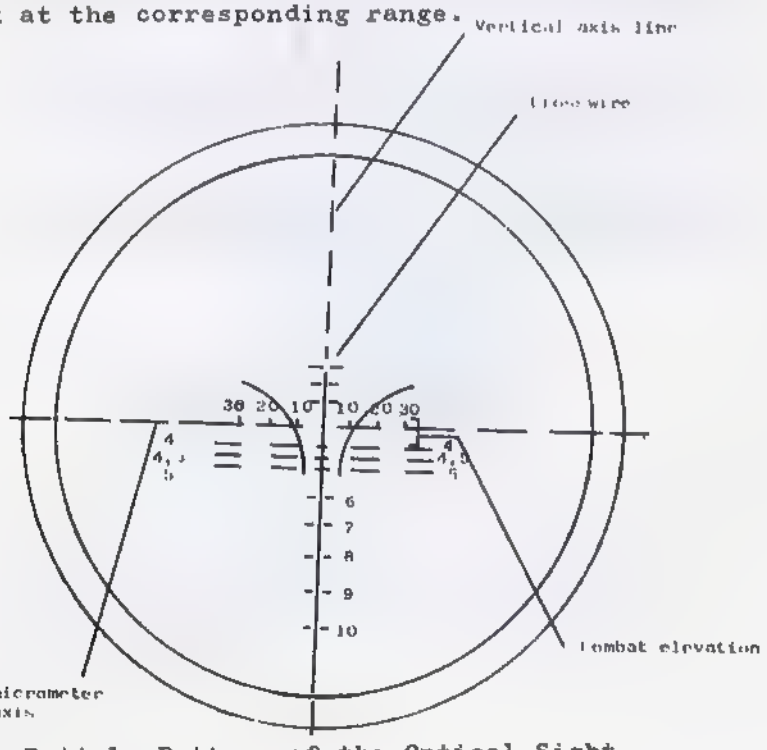


Fig 14 : Reticle Pattern of the Optical Sight.

UTILIZATION OF THE OPTICAL SIGHT

8. Estimating Range. The curved stadia lines can assist the operator in estimating the range to a target. The correct range will be indicated if the target with a length of 6 m fits between the two stadia lines (side view), or when a target with a width of 3 m fits between the vertical axis and a stadia line (front or rear view). The correct range can be read off at the point on the centre of the target.

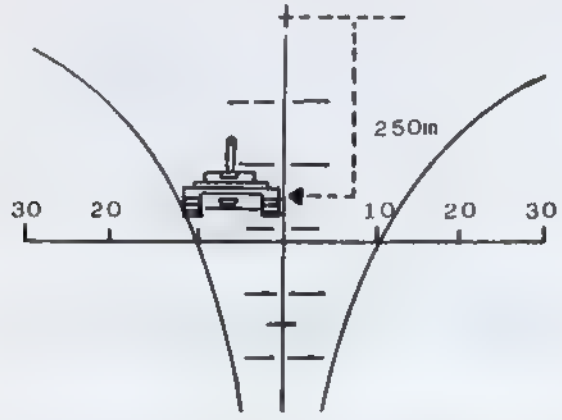


Fig 15 : Tank at 250 m - Front view.

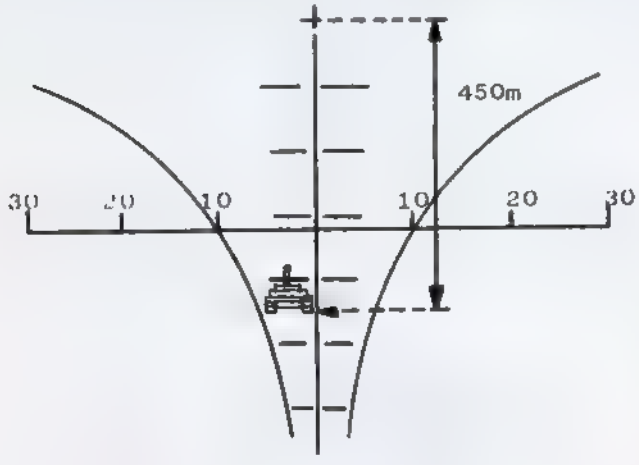


Fig 16 : Tank at 450 m - Front view.

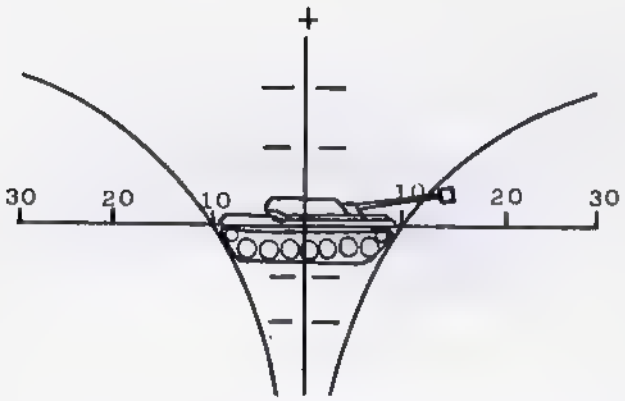


Fig 17 : Tank at 300 m - Side view.

9. Aiming with the Optical Sight

a. Stationary Targets. On ranges 0 - 330 m the trajectory is never higher than 1,9 m.

i. Ranges 0 - 330 m : Point of corresponding range on the vertical axis in the sight, on the base/ground line of the target.

ii. Ranges 0 - 330 m, rapid fire : Combat range line (330 m) on the base/ground line of the target, with the vertical axis on the centre of the target.

iii. Ranges 330 - 1 000 m : Point of corresponding range on the vertical axis in the sight, on the centre of the target.

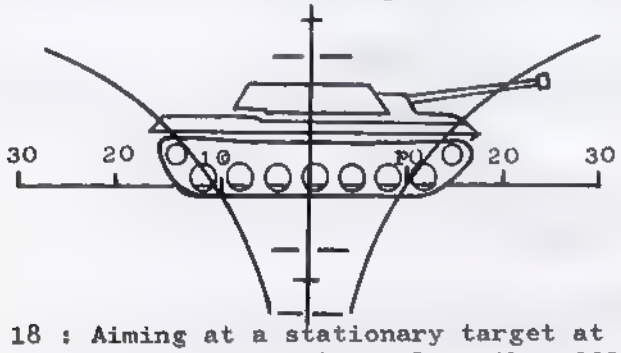


Fig 18 : Aiming at a stationary target at a range equal to or less than 330 m : Rapid fire.

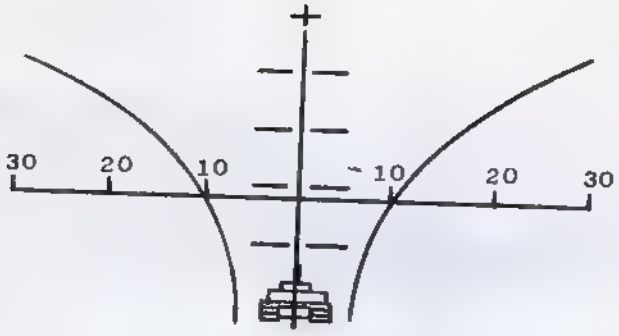


Fig 19 : Aiming at a stationary tank at 500 m.

b. Moving Targets

i. Ranges 0 - 330 m : Point of corresponding range on or in line with the speed of the vehicle, on the base/ground line of the ve= hicle.

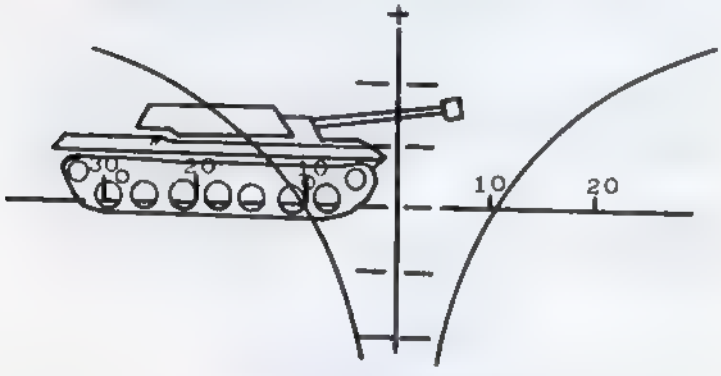


Fig 20 : Aiming at a tank moving from left to right at a speed of 20 km/h at range of 200 m.

ii. Ranges 0 - 330 m, rapid fire : Combat range line (330 m) with speed of vehicle on the base of the vehicle.

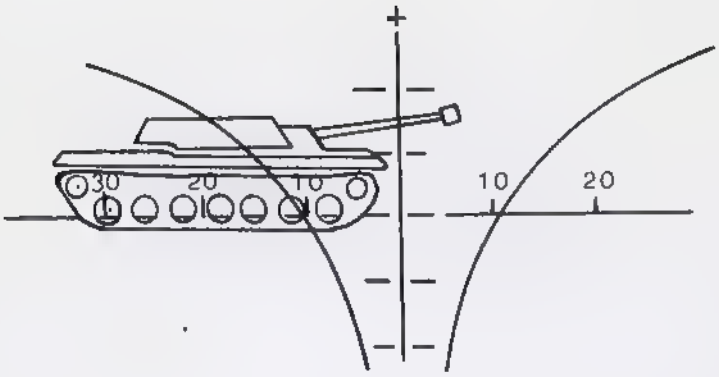


Fig 21 : Aiming at a tank moving from left to right at a speed of 20 km/h at range of 300 m.

iii. Ranges 330 - 500 m : Corresponding range and speed of the vehicle on the centre of the target.

CONCLUSION

10. The Optical Sight is a precision instrument, specially designed for the weapon. At all times, when not in contact with the enemy, or when contact is not immenent, the sight must be replaced in the rear of the rocket launcher, in order to prevent it from unnecessary damage.

11. As the trajectory of the weapon is between 0,2 and 1,9 m on ranges of 100 to 330m, aiming with the combat range line on the base of the target will still ensure a frist-round hit.

12. It is advisable to use the rocket launcher only up to 500 m on moving targets, as estimation of range and speed of the vehicle within 500 m will be more accurate.

89 mm ROCKET LAUNCHER

CHAPTER 5 : LOADING, FIRING AND UNLOADING

AIM

1. To explain the actions during loading and unloading of the weapon, as well as safety involved during these actions.

INTRODUCTION

2. Most accidents can be attributed to one or more of the following :

a. Personnel inadequately trained.

b. Faulty procedures followed.

c. Disobeying prescribed safety rules and regulations.

3. In order to prevent accidents, actions should always follow a set sequence. Adherence to this sequence will prevent unintentional firing of the weapon, thus ensuring the safety of the crew as well as other personnel around the weapon. Orders must alsways be given loudly and clearly and must be acknowledged on receipt by repeating the complete order.

PREPARATION FOR FIRE

4. Serviceability of Equipment. Before firing can commence, the No 1, who is responsible for firing the weapon, must satisfy himself that the weapon and equipment are serviceable.

a. Rocket Launcher

i. Remove the weapon from its protective carrying bag.

ii. Remove the muzzle cover.

iii. Inspect the exterior of the rocket launcher for damage; eg, cracks, cuts, dents, etc.

iv. Ensure that the electromagnetic system is functioning by test-firing the weapon with

the sight still locked in the carrying po= sition. Observe the following :

(1) The control bulb situated in the rear of the sight should flash.

(2) If no flash occurs after a second test- fire, ensure that the sight is fitted correctly, with the arrows opposite each other.

(3) Unscrew the bulb and refit the spare bulb sit' ated in the front lens pro= tector.

(4) Test-fire again. If there is still no flash, the weapon is unserviceable and must be repaired by an armourer.

v. While test-firing, test the mechanical func= tioning of the firing mechanism for freedom of movement and general smooth operation.

vi. Remove the optical sight and fit on weapon. Ensure that contact areas on weapon and sight are clean and free from dirt, dust, etc.

vii. Ensure that electric contact points at the rear of the tube are clean and free from dirt, dust, and moisture.

viii. Inspect the barrel for cleanliness and/or damage.

ix. Remove lens covers, inspect lenses visually and clean with brush if necessary.

x. Unfold the front handle by pressing the lock-button Ensure that it is locked in position.

xi. Push the bipod lock out of the locked po= sition, press the lock-button and pull out the bipod.

xii. Adjust the position of the shoulder-rest. Ensure that it is locked in position. Re= position the shoulder-rest locking catch.

xiii. The weapon is now ready to load.

Note 1. In active conditions the No 1 will execute the above before contact with the enemy is possible. In the firing position he will only fit the sight and adjust the bipod.

5. Loading the Weapon. While the No 1 is preparing the weapon, he will issue the order "Prepare to load". The actions of the No 2 will be the following :

a. He will remove four rockets from their containers.

b. While removing the front cap of one rocket, he will report "Ready".

c. On hearing "Ready" from the No 2, and when the weapon is correctly adjusted, the No 1 will isue the order "Load". His actions will be as follows :

i. He will ensure that there are no personnel or inflammable material within the prescribed danger areas.

ii. Ensure that the line of sight to the target is not obscured.

iii. Put his right hand on top of the barrel away from the firing mechanism and order "Load".

d. On hearing the order "Load", the No 2 will ensure that the hand of the No 1 is away from the firing mechanism, and act as follows :

i. Line up the arrow on the prepared rocket (with the front cap off) with the arrow on the rear of the rocket launcher.

ii. Introduce the rocket into the rocket launcher until the block stops the container.

iii. Lock the rocket in the rocket launcher by turning the container clockwise (± 1/6 revolution) until it stops.

iv. Remove the rear plug which serves as circuit breaker.

v. Tap the No 1 on the shoulder or head and report "Loaded".

vi. Prepare the other trhee rockets for loading.

e. The weapon is now ready for firing.

FIRING AND UNLOADING

6. Firing the Weapon

a. On hearing the report "Loaded", the No 1 replaces his hand on the firing generator handle.

b. He aligns the sight roughly with the target and squeezes the firing handle against the generator handle. (A "click" should be heard).

c. He then lays on the target with the optical sight as described above and, when satisfied, squeezes the trigger.

7. Reloading. After firing and if required to fire some more, the following takes place :

a. The No 1 takes his hand away from the firing generator handle while ordering "Reload".

b. The No 2 removes the expended container, ensuring that the hand of the No 1 is clear of the firing generator handle.

c. He reloads the weapon as described before, and reports "Loaded".

d. The No 1 may continue engaging a target as explained.

8. Unloading. If for some or other reason the weapon is not fired, the actions will be as follows :

a. The No 1 will remove his hand from the giring generator handle and order "Unload".

b. The No 2 ensures that the hand of the No 1 is clear of the handle and replaces the rear cap on the container.

c. He unlocks the container and pulls it out of the rocket launcher.

d. He replaces the front cap and reports "Safe".

e. If no other threat exists, he will recondition the other three rockets.

IMMEDIATE ACTION DRILL

9. The 89 mm Rocket Launcher has very few misfires. However, there is a possibility that it may occur. It will be rectified in the following sequence.

10. Combat Conditions

a. Wait 30 seconds while maintaining the weapon aimed at the target. The No 1 will shout "Misfire" and take his hand away from the firing generator handle.

b. The No 2 will replace the rear plug, unload, place the container away from other ammunition and report "Safe".

c. If necessary, the No 1 will order "Reload".

d. The No 2 will ensure that the contact points in the rocket launcher are clean and act as previously taught.

e. If another misfire occurs, check the electric functioning of the weapon by menas of the control bulb. If the weapon's electrical system is functioning, check the lot No of the ammunition and submit a misfire report.

f. Reload with ammunition of another log No, and continue firing.

11. During Training. The above sequence will be followed with the exception of par 10. a. Instead of waiting 30 seconds, the No 1 will, during peacetime training, wait 2 minutes.

CONCLUSION

12. The 89 mm Rocket Launcher is a reliable weapon. Misfires may occur in the following circumstances :

a. Weapon not properly maintained.

b. Electrical system out of order and not functioning properly.

c. Faulty ammunition.

13. During loading, firing, and unloading, orders must be

given loudly and clearly. A good mutual understanding must exist between the No 1 and 2, as they will be wearing ear protectors/plugs. The complete order must be repeated in acknowledgement by the recipient to prevent misunderstanding.

89 mm ROCKET LAUNCHER

CHAPTER 6 : MAINTENANCE

AIM

1. To explain the proper care, cleaning and maintenance of equipment.

INTRODUCTION

2. Most misfires result from lack of, or incorrect maintenance. Preventive maintenance and care ensure proper functioning of equipment and increase useful life of the weapon.

ROUTINE MAINTENANCE

3. Afte Firing

a. Remove the empty container from the weapon.

b. Clean the weapon with a dry cleaning brush.

c. Using a dry clean rag (no abrasive material), clean the electrical contact points inside the weapon.

d. The outside of the barrel and other external parts must be cleaned with a dry clean rag, including the resting surfaces of the optical sight.

e. The Optical Sight

i. Clean exterior of lenses with a dry clean soft brush.

ii. With a dry clean rag, clean the resting surfaces of the optical sight. Use no abrasives.

iii. Very lihgtly oil the resting surfaces of the optical sight, as well as the locking eye.

iv. Replace the sight in the rear of the barrel.

f. Replace the muzzle cover.

g. Place weapon in its carrying bag.

4. Before Firing. As described in Chapter 5, par 4.

REPLACEMENT OF PARTS

5. The weapon has been developed to need no setting or adjustment by the user. In case of an unserviceable weapon or maladjustment of the optical sight, a qualified armourer is responsible for repairs.

6. If the optical sight has been used under unfavourable conditions (water, mud, etc) the casing may be disassembled by an armourer and the sight removed from its casing for cleaning and drying purposes.

7. No disassembling is permitted at user's level with the exception of removing the optical sight, cheek-rest, and sling.

MAINTENANCE EQUIPMENT

8. Equipment with the Weapon

a.	Cleaning rod (sections X4)	X 1.
b.	Brush (round 88 mm)	X 1.
c.	Brush (soft)	X 1.
d.	Cleaning rod locknut	X 2.
e.	Cleaning rod locknut washer	X 2.
f.	Bags carrying maintenance equipment	X 1.

CONCLUSION

9. Maintenance of the 89 mm Rocket Launcher has been kept to a minimum. Oil on the weapon, with the exception of me= tal parts, must not be used, nor must any abrasiv material.

10. Repairs to the weapon, as well as adjustment of the sight, must be executed by a qualified armourer.

89 mm ROCKET LAUNCHER

CHAPTER 7 : EMPLOYMENT OF THE WEAPON

AIM

1. To discuss the general employment of the weapon.

INTRODUCTION

2. The best firing position for moving targets is the one that gives the greatest flexibility, combined with comfort and steadiness. This has been proved to be the kneeling or the sitting position, when firing in the open or from behind cover.

POSITIONS

3. Requirements of a Firing Position

a. Weapons must be deployed in depth.

b. Weapons must be able to support each other mutually.

c. Positions must be defiladed wherever possible.

d. The obstacle must be covered (within the planning range of the weapon).

e. Alternative positions must be prepared.

f. Positions and routes to positions must have sufficient cover to permit movement between main and alternative positions.

g. The positions must be dug in and camoflaged.

h. Positions must be protected by the disposition of own forces.

j. Arcs of fire must overlap.

4. Firing Positions. The rocket launcher can be fired from any of the normal rifle-firing positions :

a. The Lying Position

i. Ensure that there are no obstructions behind the weapon.

ii. Ensure that the prescribed danger area is clear of personnel and inflammable material.

iii. The body and legs of the No 1 must be, as far as possible, at right angles to the rocket launcher. It is important that no part of the body or legs is behind the laun= cher.

iv. The No 2 must be at right angles to the launcher, on the opposite side of the No 1. His head must be opposite the No 1's right shoulder to be able to communicate and assist in observation of fire. No part of his body or legs must be behind the launcher

b. The Kneeling Position. This position has been found to be the best when firing in the open, or from behind cover or modified trench. It is easy to follow a moving target. It is also pos= sible to get down to cover when firing from a defiladed position.

i. Ensure that there are no obstructions behind the weapon.

ii. Ensure that the prescribed danger area is clear of personnel and inflammable material.

iii. The body is held erect and swinging is done from the waist.

iv. The No 2 will kneel down opposite the No 1's right shoulder, close enough to communicate and assist in observation of fire.

c. The Sitting Position. The same as for rifle fir= ing. Ensure that safety precautions are complied with. The No 2 may sit or kneel opposite the No 1, as for the kneeling position.

d. The Standing Position. The standing position may be used when firing from high cover or when firing from a trench, modified to take the crew and equipment during the defence :

i. Comply with safety precautions as mentioned previously.

ii. The No 1 will stand half right to the target, body evenly balanced on both feet, or with elbows and bipod resting on the parapet.

iii. The No 2 will stand facing square to the launcher opposite the No 1's shoulder.

EMPLOYMENT OF THE WEAPON

5. Siting of the Weapon. The following is very important :

a. The most important factor in the deployment of this weapon is the prevention of being neutralized or destroyed by armour, before being effectively employed :

i. Good camouflage and concealment is essential.

ii. In siting the weapon, the requirements of fire positions must be considered and applied intelligently.

iii. Rear slope positions must be considered as well as defiladed positions.

b. Main and alternative positions are important, and movement between these positions must be possible.

6. Employment

a. Defensive Operations

i. To cover the minefield and/or obstacle.

ii. To cover gaps in the minefield.

iii. To cover armour approaches. The weapon must not be deployed on the approach but prefer= ably on a flank.

iv. Tank-hunting parties.

v. Ambushes.

vi. To cover any penetration of armour within the position.

vii. During raids.

b. Offensive Operations

i. Deployed on the objective during consolidation or re-organisation to repel an enemy armoured counter-attack.

ii. Employment in secondary rôle against :

(1) Bunkers.

(2) Reinforced positions.

(3) B Vehicles.

(4) Riverboats, gunboats, etc.

iii. Protection of a flank.

iv. During house-clearing and street-fighting.

v. During raids on enemy HQs, strong points, or supply dumps.

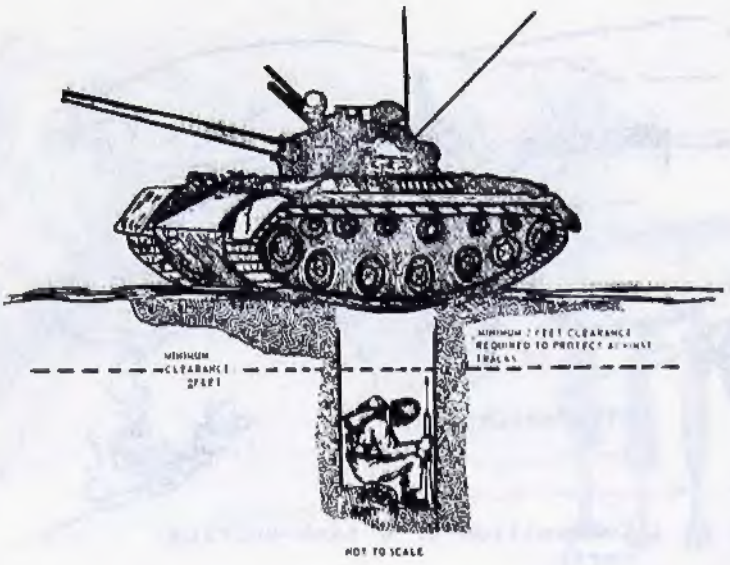


Fig 22 : Trench giving protection against armour.

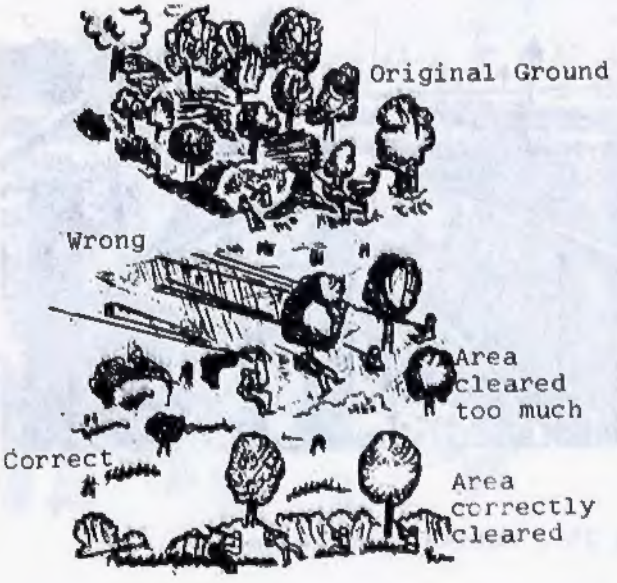


Fig 23 : Clearing of a defensive area

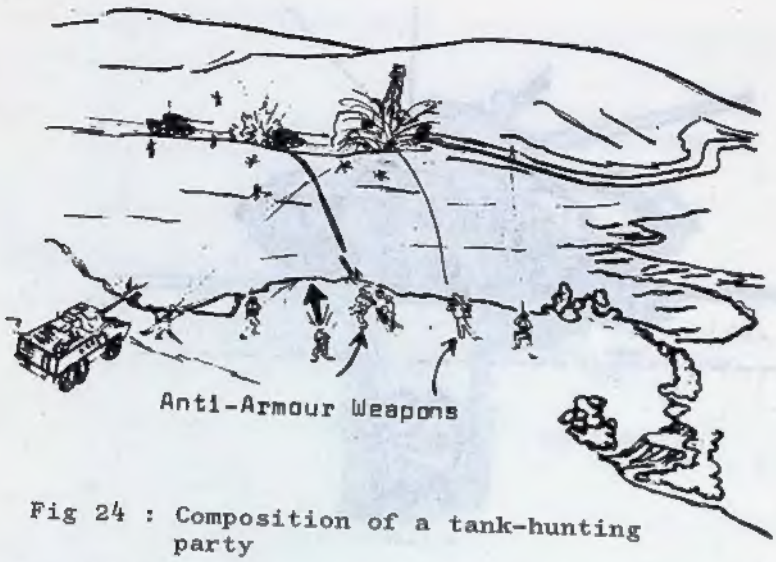


Fig 24 : Composition of a tank-hunting party

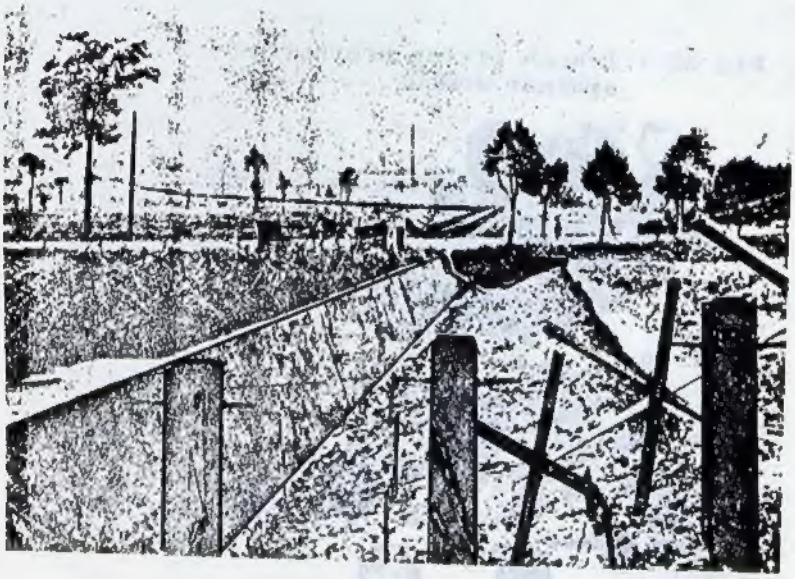


Fig 25 : Anti-armour obstacles

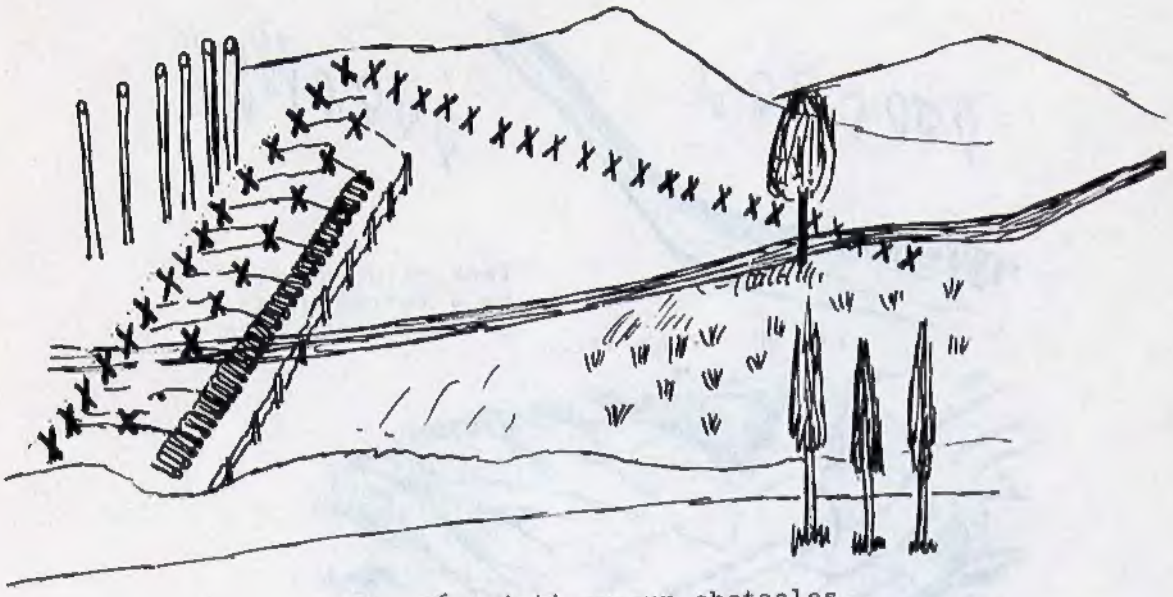


Fig 26 : Anti-armour obstacles.

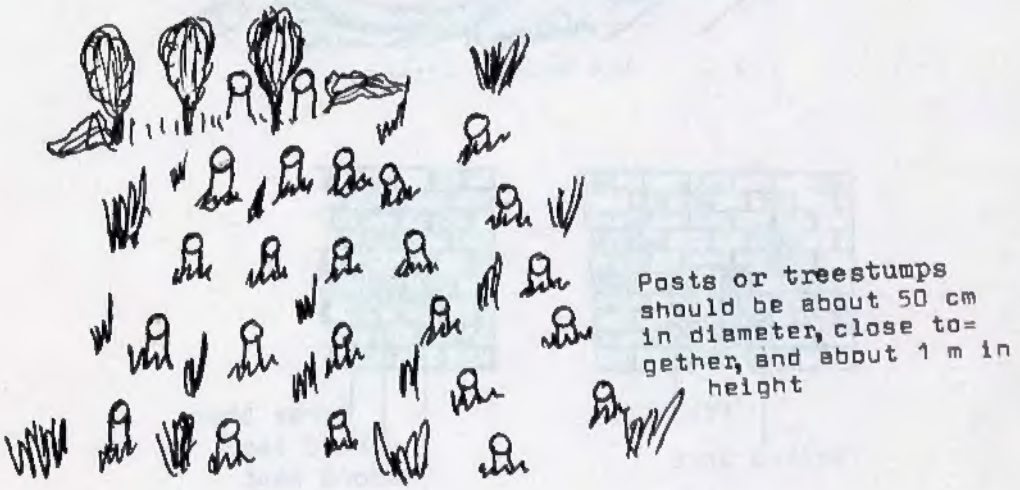


Fig 27 : Post obstacles.

Tank ditch should be 4 metres wide by 1,8 metres deep

Fig 28 : Tank ditch.

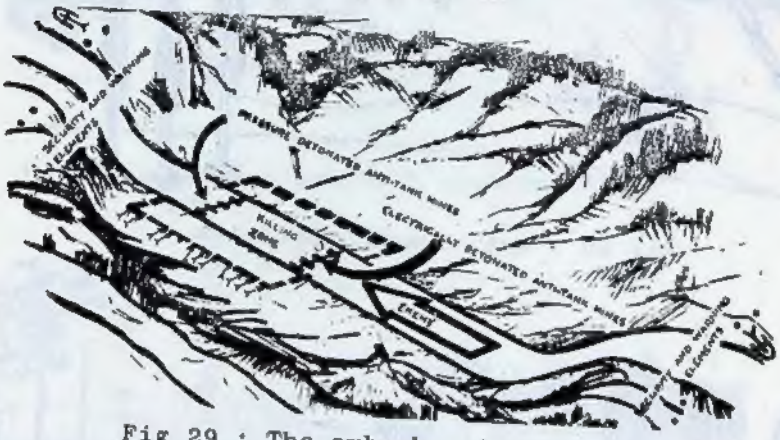


Fig 29 : The ambush set-up.

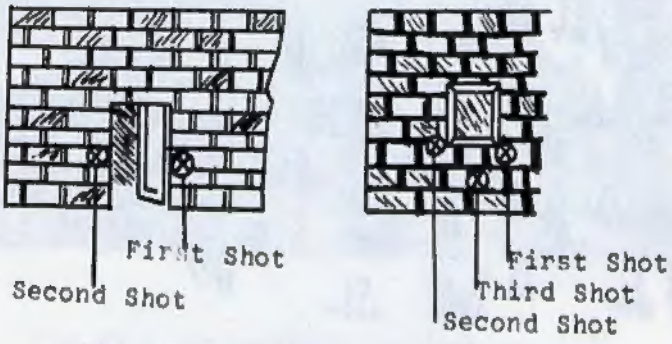


Fig 30 : House-clearing.